CHAPTER 7: CELLULAR RESPIRATION AND FERMENTATION

FOCUS QUESTIONS

7.1. $C_6H_{12}O_6$; 6 CO_2; energy (ATP + heat)

7.2.
a. oxidized
b. reduced
c. donates (loses)
d. oxidizing agent
e. accepts (gains)

7.3.
a. O_2
b. glucose
c. Some is stored in ATP and some is released as heat.

7.4.
a. electron acceptor (or carrier or shuttle). It is a coenzyme that works with enzymes called dehydrogenases.
b. NADH

7.5.
a. 2 ATP
b. 2 three-carbon sugars (glyceraldehyde-3-phosphate)
c. 2 NAD^+
d. 2 NADH + $2H^+$
e. 4 ATP
f. 2 pyruvate

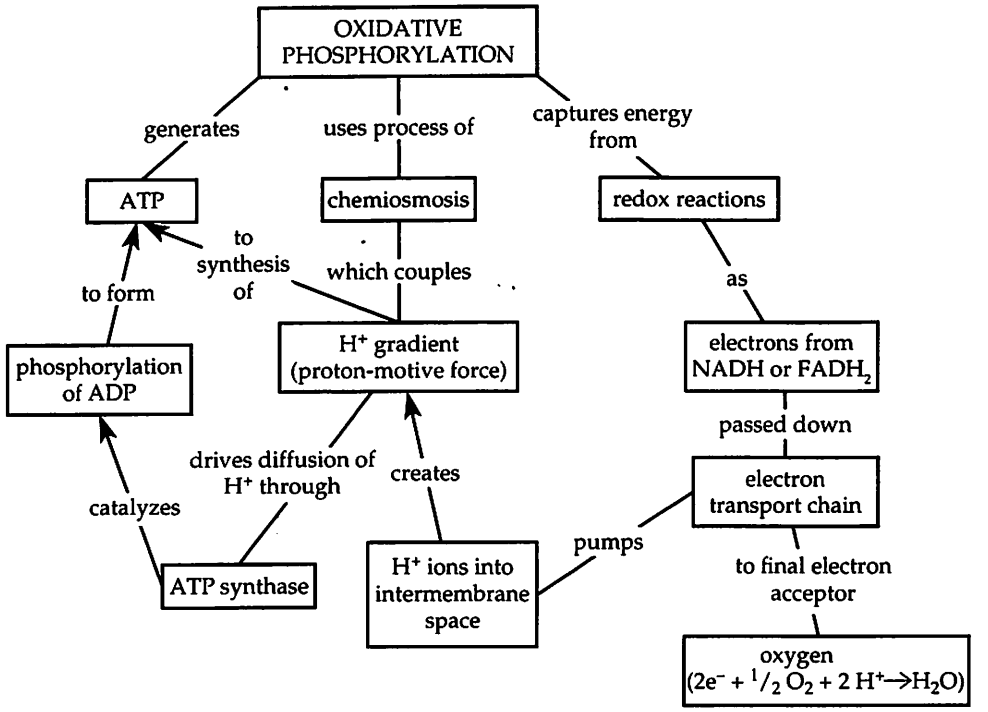
7.6.
a. pyruvate
b. CO_2
c. NADH + H^+
d. coenzyme A
e. acetyl CoA
f. oxaloacetate
g. citrate
h. NADH + H^+
i. CO_2
j. CO_2
k. NADH + H^+
l. GTP (may make ATP)
m. $FADH_2$
n. NADH + H^+

7.7.
a. intermembrane space
b. inner mitochondrial membrane
c. mitochondrial matrix
d. electron transport chain
e. NADH
f. NAD^+
g. $FADH_2$
h. 2 H^+ + ½ O_2
i. H_2O
j. chemiosmovsis
k. ATP synthase
l. ADP + $\textcircled{P}_i$
m. ATP

7.8.
a. − 2
b. 4
c. citric acid cycle
d. 26 or 28
e. 32
f. 2
g. 6
h. 2
i. 2

7.9. Respiration yields up to 16 times more ATP than does fermentation. By oxidizing pyruvate to CO_2 and passing electrons from NADH (and $FADH_2$) through the electron transport chain, respiration can produce a maximum of 32 ATP compared to the 2 net ATP that are produced by fermentation.

SUGGESTED ANSWERS TO STRUCTURE YOUR KNOWLEDGE

1. Use Focus Questions 7.5, 7.6, and 7.7 to help you review these pathways.
2. 

3.

Process	Brief Description	Inputs	Output
Glycolysis	Oxidation of glucose to 2 pyruvate, production of 2 ATP net	glucose 2 ATP	2 pyruvate 4 ATP (2 net) 2 NADH
Pyruvate to acetyl CoA and citric acid cycle	Oxidation of pyruvate to acetyl CoA, which combines with oxaloacetate → citrate. Citrate is cycled back as redox reactions produce NADH and $FADH_2$ and CO_2 is released. ATP is formed by substrate-level phosphorylation.	2 pyruvate 2 oxaloacetate	6 CO_2 8 NADH 2 $FADH_2$ 2 ATP
Oxidative phosphorylation (Electron transport and chemiosmosis)	NADH and $FADH_2$ transfer electrons to an electron transport chain. In a series of redox reactions, H^+ is pumped into intermembrane space, and electrons pass to O_2. Proton-motive force drives H^+ through ATP synthase to make ATP.	10 NADH 2 $FADH_2$ $H^+ + O_2$	H_2O 28 ATP (max)
Fermentation	Anaerobic catabolism: glycolysis followed by oxidation of NADH to NAD^+ so glycolysis can continue. Pyruvate is either reduced to ethyl alcohol and CO_2 or to lactate.	See glycolysis above 2 pyruvate 2 NADH	2 ATP 2 NAD^+ 2 ethanol and 2 CO_2 or 2 lactate

ANSWERS TO TEST YOUR KNOWLEDGE

Multiple Choice:

1. a	4. e	7. b	10. a	13. e	16. d	19. e	21. b
2. d	5. c	8. b	11. a	14. d	17. b	20. c	22. c
3. c	6. d	9. d	12. d	15. e	18. c		